PROPER NAME RETRIEVAL IN NORMAL AGING

By

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Word retrieval deficits and preferential decline in the retrieval of proper names (people's names) have been described as phenomena of normal aging. Knowledge from models of language and information processing suggests that difficulty with proper name retrieval might reflect the specifity of search required to retrieve an individual's name, a decline in the amount of semantic information available pertaining to individuals, a loss of lexical-phonologic knowledge about people's names, or some combination of all of the above. The purpose of this dissertation is to examine the relative performance of older and younger subjects on tasks of proper name retrieval, exploring possible lexical, semantic, and age-related differences in patterns of performance, in order to give a better understanding of memory and aging in general.

CHAPTER 1
INTRODUCTION

As people age, even in the absence of dementia or pathologic memory impairment, trouble recalling specific words is a common complaint (MacKay, Conner, Albert, & Obler, 2002). This decline in word retrieval appears to be greatly influenced by word frequency, with greater age-related recall difficulties for more infrequently used words (Spieler & Balota, 2000). More dramatic is the difficulty older people have in recalling proper names (Evard, 2002; Pluchon, Simmonet, Toullat, & Gil, 2002), a complaint encountered even more frequently than that of difficulty with word recall in general. The question arises as to whether proper names are, in fact, selectively difficult for normally aging individuals to recall, and if so, what aspects of proper names render them selectively vulnerable to retrieval problems? The purpose of this dissertation is to confirm that preferential proper name recall decline is associated with normal aging, and to explore possible lexical, semantic, and age-related differences in patterns of performance on proper naming tasks, in order to better explain this phenomenon and give a better understanding of memory and aging in general.

Aging and Long-Term Memory

Hand-in-hand with noted changes in aspects of language, there is also the report of general decline in overall memory and recall as a function of advancing age, and thus any investigation of proper name/word retrieval decline must also consider the impact of memory decline in general. With aging there is frequently a decrement in memory (Burke & Light, 1981). Memory, however, is not a unitary function, and different forms of

memory appear to be mediated by different brain networks. For example, memories have been divided into explicit versus implicit and procedural versus declarative. In turn, declarative memories have been divided into semantic versus episodic memory.

While initially conceptualized as functionally independent, semantic memory (information regarding learned facts and world knowledge) and episodic memory (information regarding personally experienced and temporally coded knowledge) were later viewed as intertwined, with episodic memory embedded in and dependent upon semantic memory (Tulving, 1972 & 1984). Patterns of performance on laboratory tasks suggest that older individuals show poorer performance than their younger peers on episodic memory tests, whereas their performance on semantic memory tasks, such as vocabulary tests, shows no age-related decline (Light & Burke, 1993). Naming, however, which is also dependent on semantic memory, does show age-related declines in the form of reduced word-fluency and decreased performance on tasks of confrontation naming (Borod, Goodglass, & Kaplan, 1980; Obler & Albert, 1985). In addition, it is sometimes difficult to control for the influence of episodic memory on semantic tasks. For example, interpretation of words in context may depend greatly on the prior context. Rather than neatly compartmentalized or highly encapsulated modular systems, semantic and episodic knowledge might influence or even share representations (Dell, 1986).

With respect to learning, older adults show minimal decline when tested with implicit measures of recall, even as they demonstrate age-related waning in explicit recollection of the same material (Burke & Light, 1981). Moscovitch (1982) found that response latency was shorter for both older and younger adults with second presentation of words in a lexical decision task, even though recognition memory was better for the

young subjects. In another experiment, similar findings were reported: speed of identification of perceptually degraded words was improved comparably in both young and old subjects based upon prior exposure, but the older subjects showed poorer recall and recognition for the same words (Light & Singh, 1987).

Age differences in memory performance may also be related to a decline in inhibitory processes that filter out distracting or irrelevant information. To test this distraction theory, Kausler and Kleim (1978) examined the ability of older and younger subjects to ignore irrelevant information and focus attention only on those items identified as needing to be recognized in future. In this paradigm, two or more items were presented together, but only one was identified as "correct" (to be recognized later); correct items were underlined, incorrect items were not. After a delay, subjects were shown the same item combinations in the absence of the underlined indicator, and asked which of the items had been previously designated as "correct." The key to performing well on this task was thought to be the ability to focus only on the "correct" items, and ignore or inhibit the other items, during initial presentation. It was predicted that a degraded inhibitory process would place elderly subjects at a disadvantage (Kausler, Kleim, & Overcast, 1975), and that if this were the case, elderly subjects should demonstrate increased difficulty with the task as the number of incorrect items per each correct stimulus increased. As expected, young subjects performed better than elderly subjects on both one- and three-foil conditions, and elderly subjects performed worse when there were three foils than when there was one. While these results support the postulate that a decrease in the ability to inhibit irrelevant information may contribute to the memory declines reported as a function of aging, a study that presented items on a

grocery list preceded by either the word "get" or the words "don't get" showed no preferential decrease in elderly subjects' ability to inhibit the incorrect ("don't get") items as assessed by their ability to recall "correct" items (Pavur, Comeaux, & Zeringue, 1984).

While there seems to be some evidence that memory deficits relating to recognition and recall of external stimuli relate to impaired inhibition of irrelevant information, it is also possible that there are age differences in the inhibitory process as it relates to internal stimuli such as thought and "inner speech." If there is an age-related decrease in the ability to inhibit irrelevant internal stimuli, then elderly subjects should have more intrusive errors on tasks of word recall. In support of this idea, slightly more intrusive errors have been reported for elderly subjects on successive word-learning tasks (Stine & Wingfield, 1987). One curious finding, however, suggests that intrusive, irrelevant thoughts may actually occur more frequently in *young* subjects. During a simple vigilance task reported by Giambra (1989), young subjects were reported to have more task-irrelevant thoughts than older subjects. Thus, it appears reasonable to suggest that age-associated decline in recall and recognition of information may be related to decreased ability to ignore irrelevant information, to filter out the noise, as it were. However, the supporting evidence for this idea centers around the processing of verbal information, which raises the question of whether or not there is reason to think that visual information, and visual recall/recognition deficits, might be different in some way; this leads us to a consideration of age-related differences in performance on tasks in which the stimuli are pictures, as in confrontation naming. Additionally, it is necessary to consider language as a separate, though sub-served and sub-serving, entity as compared with language as a means of examining the relative resilience and vulnerability

that different domains of language demonstrate as a function of aging, and the ways in which these selective strengths and weaknesses may inform our understanding of the phenomena that underlie a preferential decline in proper name recall.

Language Across the Lifespan

Language does not decline uniformly with age. Rather, some aspects show age-related decline while others do not, and some aspects of language in fact appear to demonstrate continued improvement throughout the lifespan. For example, vocabulary and complexity of expressive syntax appear to increase as a function of age (Light & Burke, 1993). By contrast, when young and old subjects are compared based on their performance on standardized tests of language and aphasia, younger subjects frequently perform better than their elder counterparts (Bayles, Tomoeda, & Boone, 1985). But, interpretation of this pattern of performance must take into account such things as cohort-related education differences and hearing loss, as demonstrated by Duffy and colleagues (1976) who found that level of education had a greater impact than age on performance on the Porch Index of Communicative Ability. In a similar manner, it has been shown that only the auditory discrimination measure of the Halstead-Reitan and Luria-Nebraska batteries appeared sensitive to age, and it is possible that this effect reflects age-related hearing impairments rather than language deficits (Goldstein & Shelly, 1984).

The most commonly reported age-related waning in language is a decline in accuracy on tasks of confrontation naming and difficulties with word finding. This "naming" problem, while reminiscent of the anomia seen in aphasic syndromes, is different in quality than the naming impairment that is associated with brain damage and aphasia. The anomia found in aphasic individuals is often characterized by paraphasias in which neologisms or erroneous words are produced (Goodglass, 1980), errors that

rarely occur in normal aging. Overall, evidence suggests that the net effect of age-related changes in language seems to be one in which older individuals generally have greater difficulty recalling specific words on tasks of confrontation naming, and exhibit some word-finding deficits in conversation, but maintain rich syntactic structures in their functional verbal communication. Given that performance on confrontation naming tasks in which there is the need to retrieve a specific lexical item demonstrates decline in elderly individuals, further examination of the process and systems involved in completing these types of tasks is necessary to understand why this preferential degradation occurs.

General Naming Impairments

In discussion of the mechanisms that may contribute to anomia, consider the following model adapted from Ellis and Young (1996):

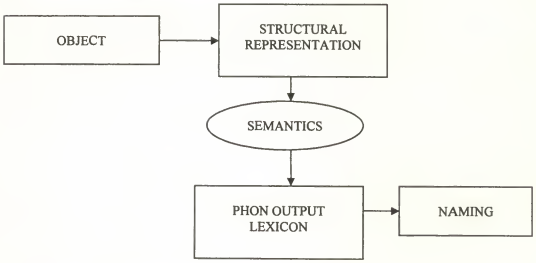

Figure 1-1. Model of Word Retrieval

The first step in the "naming" process is the input of the eliciting stimulus, either visual (a picture of the object or the object itself), tactile (the feel of the palpated object), orthographic (a written description of the object) or auditory (a verbal description of the

object, or in some cases a sample of the characteristic sound the item makes). For the purposes of this model, only visual and auditory inputs are included, and the further discussion of word retrieval and naming will center around the use of visual/picture stimuli.

Once a picture is presented, it is necessary that it be properly visualized; this is the stage at which deficits in visual acuity can undermine the naming process. In those cases where naming deficits are attributable to visual-perceptual impairments, naming performance can often be improved with auditory or tactile cues (Lawson & Barker, 1968). If visual acuity is sufficient so that a percept is properly developed, this percept must gain access to structural representations (iconic representations of previously viewed objects), and problems may arise in using visual information to form the percept, or in using the formed percept to access the previously stored representations of visual items.

When a percept accesses structural (object centered) representations it can match stored percepts and look for "familiarity." The structural representations then access conceptual representations that allow the assignment of meaning. Damage, decline, or deterioration of the access to this conceptual information, or of the information itself, leads to problems in assigning meaning to visual stimuli. The effect of loss or degradation of conceptual-semantic information, as most commonly seen in Alzheimer's disease or in semantic dementia (a form of frontal-temporal lobar degeneration), is one in which the individual may or may not be able to assign items to the correct semantic category, but not recognize the items, correctly name the items, or specify the attributes that distinguish category members from one another. Thus, in an individual who has

impaired naming and who also can not correctly sort stimuli into their correct superordinate categories, or a person who can sort by category but cannot enumerate what distinguishes one member of a category from another, the naming problem is related to degraded conceptual-semantic representations (Shwartz, Marin, & Saffran, 1979; Warrington, 1975; Martin & Fedio, 1983).

After meaning is assigned, the conceptual-semantic representation triggers the selection of the correct word from competing semantic alternatives in the phonological output lexicon. Once selected, the motoric movements necessary for the correct production of the word are programmed, and the word/name is articulated. Phonological errors can occur if the lexical representations in the ourput lexicon are somehow degraded, or if the motoric movements for the correctly selected word are mis-programmed. Dysfunction at these levels of processing results in word retrieval or word production deficits. In contrast to perceptual deficits, impaired perceptual access to conceptual-semantic representations, and degraded semantics, which are all related to early and central aspects of processing, respectively, an isolated naming/lexical retrieval impairment (without comprehension deficits) is caused by post-semantic deficits.

Word retrieval deficits in general manifest as impairments in naming. This pattern is most often manifest on tasks of visual object/picture naming, and theoretically can be induced by a deficit in the visual processing of stimuli or the development of percepts (aperceptive visual agnosia), an inability to access structural representations or a loss of structural representations (associative agnosia), an inability of structural representations to access lexical and semantic representations, loss of the conceptual-semantic information needed to comprehend the structural representations, or a loss of lexical

representations. With deficient word-retrieval, the individuals are able to correctly recognize an object, know the superordinate category to which it belongs, and know how this object is different from other objects in the same category. They are also able to select the correct name from a list of possible choices, but they are unable to spontaneously produce this name. Anomic individuals often demonstrate greater deficits in word-retrieval with word generation tasks than on confrontation naming. Thus, difficulty with word-generation tasks will often precede the appearance of confrontation naming difficulties, suggesting word-generation may be the more sensitive task in detecting word retrieval deficits (Benson 1979; Huff, 1988; Miller & Hague, 1975; Rosen 1980).

In the model discussed in this chapter, anomic deficits attributable to problems with visual perception or visual processing represent dysfunction prior to lexical-semantic processing: either problems with visual acuity, impaired visual processing, or faulty connections between visual processing centers and the conceptual-semantic knowledge store. Conceptual-semantic naming deficits reflect degradation of the conceptual-semantic networks. Deficits of naming attributed to faulty word (lexical) retrieval might result from faulty connections or weakened associations between conceptual-semantic networks and the verbal word output lexicon, degraded (lexical) word representations in the output lexicon, or problems carrying out the desired sequence of phonemes at the production level. By systematically testing the skills needed to perform processing at each of these levels, it should be possible to determine which components are contributing to a failure to name.

Proper Name Retrieval in Normal Aging

The evidence suggesting that the retrieval of proper names, in contrast to other words, is preferentially declining in normal aging is controversial. When young and old subjects' performance on three verbal fluency tests for proper names (free recall of names: "list as many 'names' as you can think of," recall of names beginning with a specified letter: "give me all the names that start with 'b' ," and recall of the names of relatives) was compared, no age-related differences could be found when effects were controlled for level of education (Tradardi, Mucignat, & Riggio, 1992). Further, when performance on proper name retrieval tasks was analyzed to examine the effect of age on other memory processes not limited to proper name retrieval, it was suggested that the effect of age on name recall is no greater than the effect of age on "earlier" stages of recognition and semantic information retrieval; in other words any deficits in proper name retrieval might be attributed to the cumulative defects in the stages of processing required to retrieve a proper name, and not some preferentially degraded knowledge pertaining to proper names per se (Maylor, 1997).

In contrast, Crook and Larrabee (1992) reported that by the fifth decade of life there is a decrease in face recognition memory, and that this decline becomes more pronounced in the seventh decade. While one possibility is that this "decline" reflects merely the stimuli themselves, with older subjects being at a disadvantage when asked to recognize "young" faces, these results cannot be explained simply on the basis of some effect of the age of the face-stimuli themselves (whether or not the pictured individuals were youthful or elderly); elderly subjects show no advantage for recognizing aged target faces as opposed to youthful target faces (Fulton & Bartlett, 1991), and young subjects have been shown to show a recognition advantage for both aged (Backman, 1991) and

youthful faces (Fulton & Bartlett, 1991). In addition, when asked to name celebrity photographs and objects (proper versus common nouns), elderly subjects experienced more tip of the tongue states for proper names but not common names as compared with younger adults (Evard, 2002).

This evidence, suggesting a preferential vulnerability of proper names to recall decline, suggests that there should be differences in the processing of proper names versus common names. One supposition is that proper names, in contrast to other categories of names, are designated arbitrarily. Semenza and Zettin (1989) report a patient with selective inability to retrieve proper names following brain injury and posit this reflects a deficit in performing arbitrary tasks. These findings were confirmed in a later study, which supported the postulate that an inability to retrieve arbitrary relations is the basis of an inability to recall proper names (Hittmair-Delazer, Denes, Semenza, & Mantovan, 1994).

Another proposed explanation is that preferential decline in proper name retrieval occurs when the connections between lexical and phonological nodes become weakened. These connections may be weakened through infrequent use (you are less likely to recall the name of an individual whose name you never had to recall very often), non-recent use (you are less likely to recall the name of an individual whom you have not seen in some time), and aging (with increased age and experience, the number of infrequently and non-recently recalled names increases). As predicted, the largest category of tip of the tongue phenomena in older subjects was the names of acquaintances who had not been contacted recently (Burke, MacKay, Worthley, & Wade, 1991). While this result is expected across the lifespan, the data indicate the finding is more robust in older individuals.

It may also be the case that difficulty in recalling proper names reflects only a problem with explicit word retrieval. To this end, repetition priming of proper names was tested in a patient with marked impairment in deliberate retrieval of person and city names. The patient's performance on repetition priming tasks was compared with normative data on the tasks (when variables of levels of processing at encoding and age were manipulated, priming effects were not influenced by either of those variables), and demonstrated normal repetition priming. This was interpreted as suggestive of the fact that there is a dissociation between explicit and implicit memory for proper names such that the deficit in proper name recall involves only deliberate access to the name while leaving pre-semantic access and representations intact (Geva, Moscovitch, & Leach, 1997).

Finally, it may also be the case that declines in proper name retrieval represent selective damage to cortices responsible for the processing of unique entities. Lesion and functional imaging studies have implicated association cortices in the left temporal lobe in the retrieval of object names belonging to conceptual categories, and proper names may merely represent a specific conceptual category. An investigation into the association between naming unique persons from faces and cortices in the left temporal pole sought to determine whether the anatomic-behavioral association reflected the specificity of the task, or preferential processing of faces by the cortices in question. To this end, PET imaging data were recorded while subjects were asked to name famous landmarks and famous faces. Retrieving both types of names resulted in activation of the same brain regions, suggesting that the role of the left temporal pole in proper name retrieval reflects the level of specificity of word retrieval, rather than the conceptual class

to which the stimulus belongs, or the specific processing of visuo-facial information (Grabowski, Damasio, Tranel, Ponto, Hichwa, & Damasio, 2001).

Summary

Based on the above review of language and memory in aging, potential mechanisms of word retrieval deficits, and unique properties of proper names, it is suspected that deficits in proper name recall can result from dysfunction at a variety of neuropsychological processing levels, and that these processes may be impacted negatively by the process of normal aging. In particular, it is suspected that preferential decline in proper name retrieval reflects the arbitrary nature of proper name assignment, the specificity of search needed to select the appropriate proper name for an individual, an age-related difficulty in suppression of irrelevant information, and possible age-related degradation of lexical-phonological and semantic knowledge. Based on these theories, this dissertation project proposes the following research questions:

Can We Document a Preferential Decline in Proper Name Retrieval that Occurs with Normal Aging?

It may be the case that older subjects show no preferential decline in proper name retrieval as compared with other naming tasks that require a highly specific lexical search. In contrast, it is anticipated that proper name retrieval will be preferentially effected in the older subjects as compared with their younger counterparts. An equivalent decrease in both proper name retrieval and retrieval of other highly specific entity names would suggest that the decline must be explained not on the basis of a unique degradation of proper name recall, but on some other, more global level such as level of education, general word retrieval impairment, etc.

Do Preferential Proper Name Retrieval Declines Associated with Normal Aging Occur as a Function of Search Specificity?

If deficits in retrieval of proper names are the result of breakdown in the specificity of search needed to select the specific name, then subjects should be able to give information along a continuum from simple recognition of faces as familiar, to more detailed information about occupation and associates, to final retrieval of names themselves. If this is the case, subjects who have difficulty naming famous faces may be able to give some semantic information about those faces which they cannot name (though the amount of information may also vary along a continuum as a function of age). However, if specificity of search is *not* the explanation for proper name retrieval decline, then subjects should be able to name all faces for which they can provide semantic information. It is predicted that normally aging individuals will have greater difficulty naming famous photographs than their younger counterparts, even when semantic information about the famous individuals can be correctly accessed.

Do Preferential Proper Name Retrieval Declines Associated with Normal Aging Result from Breakdown at the Conceptual-Semantic Level?

If declines in retrieval of proper names are the result of breakdown in the conceptual-semantic system as a function of age, then older subjects should have greater difficulty giving semantic information about famous people as compared with younger subjects. Additionally, even when semantic information can be retrieved, amount of detail should vary as a function of age. If this is the case, older subjects should give fewer semantic details for those individuals whom they are unable to name as compared with faces they *can* name and as compared with younger subjects across both sets of stimuli, though amount of semantic detail provided for "nameable" faces should be comparable between both older and younger subject groups. However, if breakdown of

the conceptual-semantic system is *not* the explanation for proper name retrieval declines, then older and younger subjects should be able to give comparable amounts of semantic information across all tasks, and older subjects should be able to provide the same level of semantic detail for familiar faces which they can and cannot name.

Do Preferential Proper Name Retrieval Declines Associated with Normal Aging Result from Breakdown at the Lexical-Phonological Level?

If proper name retrieval declines represent breakdown at the lexical-phonological level, then subjects should have difficulty accessing information about the lexical and phonological characteristics of famous people's names, such as identifying correct homophonic words and rhyming words. It may be that older subjects will perform more poorly than younger subjects on tasks which ask them to access lexical phonological characteristics of persons' names, and if so this may account for any observed discrepancy in the ability to recall proper names in older subjects as compared with younger subjects. If proper name retrieval deficits are *not* influenced by breakdown at the lexical-phonological, then both older and younger subjects should perform equally well on these types of rhyme and homophone tasks.

Hypotheses

1. Older subjects will perform comparably to younger subjects on simple, low-specificity tasks (recognition rating).

2. Older subjects will have increased difficulty as compared with younger subjects as task-specificity (profession rating) increases.

3. Older subjects will be able to name fewer famous people as compared with younger subjects.

4. Older subjects will be able to give less semantic detail for those faces they could name as compared with their younger counterparts, and will give comparatively less semantic information about individuals who are familiar but who they could not name.

5. Older subjects will perform more poorly than younger subjects on tasks which require them to access lexical and phonological characteristics of famous people's names, both for persons they could name and persons who were familiar but who they could not name.

CHAPTER 2
METHODS

The purpose of this dissertation was to learn whether preferential proper name retrieval decline is associated with normal aging, and to elucidate possible lexical, semantic, and age-related differences in patterns of performance that might account for this phenomenon should it prove existent.

Subjects

The experimental subjects for this study were 30 right-handed native English speakers between the ages of 60 and 85 years who did *not* have a diagnosis for probable degenerative dementia of the Alzheimer's type (AD) as well as 30 gender and educationally matched controls between the ages of 18 and 30. All participants were recruited from the community. The age ranges were determined based on previous work, which cited the greatest decline in proper naming in the seventh decade and beyond (age 60+), but also cited some decline beginning in the fifth decade (Crook & Larrabee, 1992). Limiting the "control" group to 30 years of age and below and the "experimental" group to 60 years of age and above offered the best chance to capture age-related differences in performance. Subjects with prior brain injuries such as strokes or head trauma were excluded secondary to concerns over differences in language and information processing that might result from these types of neurological injury. Subjects with reported learning disabilities, substance abuse, and current depression (as determined by the Geriatric Depression Scale), and patients with reported serious medical diseases (e.g., congestive heart failure, kidney failure, chronic obstructive pulmonary disease, liver failure) were

also excluded as these factors were felt to have the potential to effect lexical knowledge, language, and concentration and attention. The younger and older groups were balanced for education.

All subjects were assessed using a battery of standardized and non-standardized tests. Performance on these tests was used both to determine eligibility for participation in the study, and to examine how naming might be associated with other cognitive functions. Any subject who fell in the abnormal range on these tests was excluded, and was asked to see their physician. In such cases, a copy of these test scores was made available to the subjects and their physicians. Tests, descriptions, and (where applicable) eligibility cut-off scores listed below.

Inclusion Tests

The *Mini Mental Status Examination* (*MMSE*) (Cockrell & Folstein, 1988): The purpose of the MMSE was to exclude any older subject who demonstrated cognitive impairment in an attempt to assure that all of the older subjects fell within the normal range of memory and cognitive function. Young subjects were not given the MMSE, as it was not felt to be necessary to rule out cogntive impairment in healthy, young controls. The MMSE is a brief screening tool for dementia, designed to assess multiple aspects of cognitive functioning. Subjects had to score at least 26/30 to be included in the study.

The *Boston Naming Test* (*BNT*) (Kaplan, Goodglass, Weintraub, & Segal, 2001): This is a test of word retrieval, requiring subjects to correctly name pictures to confrontation. This test was included as a measure of overall word retrieval, to insure that individuals with difficulty on confrontation naming tasks in general were not included in the study. The short form of this test was administered to reduce total length of testing. A score of at least 13/15 was required to be included in the study.

Controlled Word Association Test (*COWA*) (Benton, Hamsher, & Sivan, 1983): This tests a subject's ability to generate words that begin with a certain letter. This test was included as a measure of individual's ability to perform lexical/phonologically mediated retrieval tasks. Subjects were given one minute each to generate as many words as they could recall that start with the letter "s". Subjects were required to generate at least 10 words to be included in the study.

Picture Description: Subjects were asked to produce a descriptive narrative of the "picnic picture" from the Western Aphasia Battery (WAB). This measure was included as a global measure of narrative communication skills, to insure that all subjects had expressive language performance within the range of "normal". Narratives were scored for fluency and information content as prescribed by the WAB scoring system. Any person with a narrative score less than 18 was excluded from the study (Kertesz, 1982).

Hearing and Vision Screening: In order to assure visual acuity sufficient to correctly see the picture stimuli and hearing acuity sufficient for performing rhyming tasks, subjects were asked to repeat a series of minimal-difference consonant-vowel-consonant word pairs (cat/cad, pop/bop, etc) and to identify verbally identified objects from a field of six black and white line drawings. To assure adequate hearing and vision, subjects had to be 90% accurate on both tasks to be included in the study.

Subject demographic information by group, as well as summary data from the inclusion tests described above, as follows:

Table 2-1. Subject Demographics

Group	Age	Sex	Yrs Ed	MMSE	Boston	WAB	"S"
Young (control)	M = 22.3 SD = 3.6	30 F 0 M	M = 16.3 SD = 0.74	n/a	M = 13.6 SD = 0.85	M = 19.4 SD = 0.35	M = 20.6 SD = 4.02

Table 2-1. Continued

Group	Age	Sex	Yrs Ed	MMSE	Boston	WAB	"S"
Older (experimental)	M = 75.6 SD = 7.9	27 F 3 M	M = 15.1 SD = 1.69	M = 28.9 SD = 1.17	M = 13.8 SD = 0.75	M = 19.1 SD = 0.67	M = 12.2 SD = 3.84

Experimental Tasks and Planned Analyses

Stimuli

Experimental stimuli consisted of 120 black and white photographs of famous people (Appendix A), 20 black and white photographs of breeds of birds (Appendix B), and 20 black and white photographs of objects (Appendix C). All pictures were 2.5 inches square. The photographs of people were distributed across three professional categories (athlete, politician, entertainer), and across "decade(s) of famous-ness" such that half of the stimuli were individuals who were famous between 1930 and 1960, and the other half of the stimuli were individuals who were famous between 1980 and 2005. This was done in an attempt to assure that both subject groups would have a large corpus of items/faces that were familiar to them. Pictures of individuals were isolated to the face/throat to remove background cues as to identity, and no writing, uniforms, or insignias were visible in the photographs. Pictures of birds and objects contained entire item, and bird photographs also contained some background items such a tree branches, leaves, etc.

Testing Procedures

All subjects were tested in a quiet room with the same examiner. Testing time varied between two and four hours. No task was timed, other than the word/fluency generation tasks which prescribe one-minute intervals for completion. Inclusion tasks were administered first, followed by experimental tasks. Participants were allowed to

take as many breaks as they wished to avoid fatigue, but all data collection was done with each participant in a single sitting to avoid opportunities to research or "look up" stimulus items. Subjects' responses were recorded by the examiner on paper for analysis at a later time, and no on-line scoring of experimental tasks was performed. Additionally, no feedback was given until testing was completed.

Test Description: Methods and Stimuli

Task I: Recognition of Famous Faces

Test of Hypothesis 1: Older subjects will perform comparably to younger subjects on simple, low-specificity tasks (recognition rating).

In order to name a photograph, subjects must first be able to recognize the face as someone that is familiar to them. This task was designed to examine both the relative number of faces recognized by the experimental groups, and the discrepancy (if such exists) between older subjects' ability to recognize famous faces as familiar as compared with their ability to recognize other highly specific entities (e.g. birds) as familiar. In this task, subjects were shown a group of 120 photographs of famous (entertainers, athletes, and politicians) faces, and asked to sort then into "familiar" and "unfamiliar" stacks (where "familiar" was defined as someone they felt they had seen before). Of those faces that were familiar, subjects were asked to rate the faces on a Likert scale of familiarity between "slightly familiar" (score = 1) and "very familiar" (score = 3). This was to help control for age-face recognition effects, as it was anticipated that older subjects would recognize different faces than younger subjects, and also have a different degree of familiarity. In an attempt to provide a control task to investigate whether proper name recall deficits reflect a problem with specificity of search that will impact all highly selective word retrieval tasks, subjects were also be shown a group of 20 photographs of

"iconic" breeds of birds (eagle, robin, ostrich, penguin, etc). Subjects were asked to sort them into familiar and unfamiliar stacks, and were asked to rate familiarity on a Lichert scale. To learn if there was any difference in recognition as a function of age, an analysis of variance (ANOVA) was performed with the between subject factors being Age (old versus young) and Sex (women versus men), and the within subject factor being Stimulus Type (face verse bird). Planned pairwise comparisons were performed for any main effects or interactions found.

Task II: Characteristics of Famous Faces

Test of Hypothesis 2: Older subjects will have increased difficulty as compared with younger subjects as task-specificity (profession rating) increases.

Of those faces identified as familiar in Task I, subjects were asked to sort the individuals pictured by occupation (politician, athlete, entertainer). The corpus of stimulus items was unique for each subject, with each subject asked to sort *only* those faces that he/she identified as familiar in Task I. An analysis of variance was used to compare the percent correctly sorted professions across experimental groups, with planned pairwise comparisons within each group.

Task III: Naming of Famous Faces

Test of Hypothesis 3: Older subjects will be able to name fewer famous people as compared with younger subjects

This task was designed to determine if in fact a preferential deficit in proper name retrieval occurs as a function of normal aging. Of those faces identified as familiar in Task I, subjects were asked to name the individuals pictured. An analysis of variance was used to compare the number of correctly named faces across experimental groups. Planned pairwise comparisons were performed for any main effects or interactions found.

Task IV: Semantic Knowledge

Test of Hypothesis 4: Older subjects will be able to give less semantic detail for those faces they could name as compared with their younger counterparts, and will also give comparatively less semantic information about individuals who are familiar but who they cannot name.

If the amount of semantic information that a subject can supply about an individual varies with a function of age, then older subjects should give fewer semantic details about those faces they identify as familiar as compared with the younger subjects. If the ability to supply semantic information remains robust with age, then older and younger subjects should perform comparably on semantic tasks. This task was designed to measure the amount of semantic information each experimental group was able to provide about the stimuli faces. Those pictures correctly identified as "famous" in Experimental Task I were used to assess semantic-conceptual knowledge. There were two semantic tests, one that used verbal questions and responses and the other that used pictures. For the verbal test the subject were shown 30 pictures of famous people correctly recognized by the subject as famous, that could *not* be named, as well as 30 famous people the subject *could* name. These were presented in random order. When a picture of a person was shown the subjects were asked that person's: 1) Profession (e.g., politician; 2 pts), 2) What they were best known for (e.g., Watergate; 1 pt), 3) The name of one associate (e.g., Halderman, Erlichman, Dean, Agnew; 1pt), and 4) Whether they were living or dead (1 pt). No information was scored 0, with score based on points assigned as noted above (maximum of 5 pts). The total number of points accumulated across all items was divided by the total number of possible points for those items, to yield a percentage of semantic information provided by each person. An ANOVA was used to determine if

subjects have more knowledge about those people named than those un-named, and to learn if older subjects have less information than younger subjects. There was also another stack of pictures of the faces that could and could not be named similar to that used above. However, in this task along with the target picture (e.g., Nixon) there were two other pictures (e.g., Gerald Ford, Elizabeth Taylor) that were placed under the target picture and the subject was asked to point to the face of the person who was most closely associated with the target picture (e.g., Ford). Accuracy was determined based on the number of correct picture selections made across all trials. Together, these two tasks provided a measure of both verbal and non-verbal semantic knowledge. The dependant variables were the percent correct. To determine if older subjects perform differently than younger subjects we performed a repeated measures ANOVA with group (younger; older) being the between subjects factor and naming performance (named versus not named) being the within subjects factor. Planned pairwise comparisons were made to examine differences within group.

Task V: Lexical Knowledge

Test of Hypothesis 5: Older subjects will perform more poorly than younger subjects on tasks which require them to access lexical and phonological characteristics of famous people's names, both for persons they could name and persons who were familiar but who they could not name.

It may also be the case the deficits in proper name retrieval reflect deficits or degradation in lexical-phonological knowledge. To test this theory, older and younger subjects underwent a test where the pictures of people they recognize as famous but could or could not name were either presented with a rhyming or non-rhyming word or non-word (e.g. Gerald Ford and "ord", or Gerald Ford and "lirp"). The subjects were asked if

the famous person's name rhymed with the presented word/non-word (e.g. "Does this person's name rhyme with 'ord'?"). Subjects also performed a similar task with the pictures of iconic breeds of birds, and with pictured objects. For example, shown a picture of an eagle, the subject was asked "does this bird's name rhyme with 'negal'?" and when shown a picture of a spoon, the subject was asked "does this object's name rhyme with 'nofa'?" The rhyming test for proper names contained 60 pairs of pictures: 30 pairs of correct rhymes and 30 pairs of non-rhymes. The rhyming tests for birds and objects each contained 20 items; 10 correct rhymes and 10 non-rhymes. The order in which the rhymes verses non-rhymes were presented was randomized. The specific trials where subjects made errors were recorded. Subjects could make errors either because they could not access the phonological lexicon for proper names, or had degradation of this lexicon. If subjects have degradation of the lexicon for proper names, then they will perform poorly on this rhyming test, but if their lexicon is intact but there is an access deficit, subject should perform well. The dependent variable (dv) was the percent of phonological-lexical errors (e.g., unaware that a pair of pictures of people of objects are homophones or rhyme). This dv was subjected to an ANOVA, with the between subject factor being age group (old and young) and the within subject factor being type of stimulus (faces of famous people or objects). Planned pairwise comparisons were conducted to examine differences within group.

Task VI: Word Generation

All other generative experimental tasks addressed proper name retrieval age-related declines in response to exogenous stimuli, but it was hypothesized that endogenous stimuli might result in different patterns of performance. To investigate this possibility, subjects were asked to perform three types of word generation tasks that mirror the

sorting and naming tasks described previously: categorical-non-proper names (e.g., fruits and vegetables), categorical-proper (e.g., names of politicians), and same-name categorical-proper (e.g., names of famous "Robert's"). An analysis of variance was conducted with group (young verses old) being the between subject factor and production tests being the within subject factor. Planned pairwise comparisons were conducted to examine differences within group.

CHAPTER 3
RESULTS

Task 1: Recognition of Familiar Faces

To test hypothesis 1, we examined the percentage of stimuli identified as "familiar" by each group. Analysis of variance and pairwise comparisons were conducted, with Bonferroni adjustment for Type I error setting alpha at 0.0167 for these analyses. It was expected that the two groups would not differ significantly in the percentage of individuals they identified as familiar, but this was not supported by the statistical analyses.

An ANOVA was conducted to examine the percentage of stimuli identified as familiar in each group, with age group as the between subject factor and stimulus type (face vs bird) as the within subject factor. There was a significant effect for face recognition ($p = 0.0008$), with the older group identifying more faces as familiar ($m = 66.9\%$, $SD = 16.98\%$) as compared with the younger group ($m = 54.2\%$, $SD = 9.22\%$). There was no significant difference ($p = 0.17$) between the groups with regards to recognition of birds.

Planned pairwise comparisons showed significant difference within group for both the older ($p = 0.0003$) and the younger group ($p < 0.000$) in the percentage of birds vs people identified as familiar, with both groups identifying a larger percentage of the birds as familiar as compared with faces. Mean percentages for each group summarized in table 3.1 below.

Table 3-1. Recognition of Familiar Faces

	% Familiar Faces	% Familiar Birds
Older	M = 66.9 SD = 16.98	M = 82.5 SD = 13.94
Younger	M = 54.2 SD = 9.22	M = 77.5 SD = 13.94

Task 2: Characteristics of Famous Faces

To test hypothesis 2, a paired-sample t-test was performed to compare the percentage of correctly identified professions for those faces identified as familiar across groups. It was expected that the older group would perform more poorly than the younger group on this task, but this was not supported by the statistical analysis. There was no significant difference ($p = 0.56$) between the performance accuracy of the young group (m = 95.8%, SD = 18.3%) and the older group (m = 95.2%, SD = 23.4%) on this task.

Task 3: Naming of Familiar Faces

To test hypothesis 3, we examined the number of faces correctly named by each group. To control for the fact that the two groups recognized different numbers of stimuli, the percentage of those faces identified as familiar and correctly named for each group was used as the "number" of faces correctly named. Analysis of variance and pairwise comparisons were conducted, with Bonferroni adjustment for Type I error setting alpha at 0.0167 for these analyses. It was expected that the older group would name significantly fewer faces than the younger group, but this was not supported by the statistical analyses.

An ANOVA was conducted with age group as the between subject factor and stimulus type (face vs bird) as the within subject factor. There was a no significant group effect for face naming ($p = 0.81$), with both groups naming comparable percentages of those faces they identified as familiar. There was also no significant difference ($p = 0.17$) between the groups with regards to naming of birds.

Planned pairwise comparisons within group revealed that there was no significant difference in the percentage of familiar birds named as compared with the percentage of familiar faces named for the older group ($p = .032$) or the younger group ($p = 0.56$). Mean performance for each group on each task summarized in table 3.2 below.

Table 3-2. Naming of Faces

	# Faces	# Birds	% Fam Faces (Named)	% Fam Birds (Named)
Older	M = 64.2 SD = 22.82	M = 16.5 SD = 2.79	M = 78.6 SD = 14.89	M = 82.3 SD = 13.94
Younger	M = 51.9 SD = 14.95	M = 15.5 SD = 2.79	M = 79.6 SD = 2.42	M = 77.3 SD = 1.94

Task IV: Semantic Knowledge

To test hypothesis 4, we examined the percentage of verbal and non-verbal semantic information provided by each group. Analysis of variance and pairwise comparisons were conducted, with Bonferroni adjustment for Type I error setting alpha at 0.0167 for these analyses. It was expected that the two groups would differ significantly in the percentage of semantic information provided for both named and un-named familiar faces; as expected, older subjects did give less semantic detail for faces they

named than did younger subjects, but there was no difference between the amount of information provided for un-named faces.

An ANOVA was conducted with age group as the between subject factor and with percentage of semantic information by response category (named vs un-named familiar) as the within subject factor. The analysis included both the verbal (naming profession, what the person was famous for, a known associate, whether the person was living or dead) and non-verbal (selecting the correct associate picture) semantic responses. There was a significant effect of group on the amount of verbal semantic information provided ($p = .008$) and accuracy on non-verbal semantic tasks ($p = .002$) for those items named, with the younger group demonstrating an advantage in both areas. There was no significant difference between groups in the amount of verbal ($p = 0.017$) and non-verbal ($p = .415$) semantic information provided for familiar faces that could *not* be named.

Planned pairwise comparisons were conducted to examine the amount of verbal and non-verbal semantic information provided by older subjects for those persons they could name as compared to those persons who were familiar and could not be named; there was a significant within group difference between both verbal ($p < 0.001$) and non-verbal ($p = 0.005$) semantic information as a function of whether or not the item was named, with older subjects performing both tasks with greater accuracy for those stimuli which they named. Mean performance for each group on each task summarized in table 3.3 below.

Table 3-3. Semantic Knowledge

	% Verb Sem (named)	% Verb sem (un-named)	% Non-Ver Sem (named)	% Non-Ver Sem (un-named)
Older	M = 88.3 SD = 6.59	M = 72.8 SD = 11.0	M = 83.7 SD = 15.29	M = 71.9 SD = 16.21

Table 3-3. Continued.

	% Verb Sem (named)	% Verb sem (un-named)	% Non-Ver Sem (named)	% Non-Ver Sem (un-named)
Younger	M = 92.3 SD = 4.53	M = 64.8 SD = 13.89	M = 93.6 SD = 6.83	M = 75.2 SD = 14.92

Task V: Lexical Knowledge

To test hypothesis 5, we examined the accuracy of performance for both groups on the rhyming discrimination task. Analysis of variance and pairwise comparisons were conducted, with Bonferroni adjustment for Type I error setting alpha at 0.007 for these analyses. It was expected that the older group would perform more poorly on lexical decision tasks for those items that could not be named as opposed to those that could, and that lexical performance in general would be poorer than that of the younger group. While the older subjects *did* perform more poorly when asked to perform rhyming tasks for familiar, un-named faces as opposed to those faces that were named, the statistical analysis did not support between group differences on the task.

An ANOVA was conducted with age group as the between subject factor and with percentage of lexical/phonologic information by response category (named vs un-named familiar) and by stimuli category (faces vs birds vs objects) as the within subject factors. There was no significant effect of group on the accuracy of performing the lexical/phonologic rhyme task as a function of response category ("named" $p = 0.985$; "un-named familiar" $p = 0.039$), or as a function of stimuli type ("birds" $p = 0.010$); "objects" $p = 0.382$). Planned pairwise comparisons were conducted to examine the accuracy on phonologic tasks as a function of stimulus category within group, with the older group demonstrating significantly better accuracy on the rhyming task for the

named as compared to un-named familiar faces ($p < 0.001$), but no significant difference in accuracy on the task between the named faces and birds ($p = 0.008$), or between the named faces and objects ($p = 0.016$). The younger group demonstrated significantly better accuracy on the rhyming task for the named as compared to the un-named familiar faces ($p < 0.0001$) and birds ($p < 0.0001$), but showed no significant difference on accuracy between the named faces and objects ($p = 0.07$). Mean performance for each group on each task summarized in table 3.4 below.

Table 3-4. Lexical Knowledge

	% Phon (named)	% Phon (un-named)	% Phon (birds)	% Phon (objects)
Older	M = 91.3 SD = 6.66	M = 70.3 SD = 16.50	M = 85.8 SD = 7.55	M = 95 SD = 4.55
Younger	M = 91.3 SD = 6.80	M = 60.4 SD = 19.63	M = 78.7 SD = 12.60	M = 94 SD = 4.23

Task VI: Word Generation

To examine potential between and within group differences on self-generated vs confrontation stimuli tasks, we looked at performance on general semantic, specific semantic, lexical, and proper name fluency tasks. Analysis of variance and pairwise comparisons were conducted, with Bonferroni adjustment for Type I error setting alpha at 0.006 for these analyses. It was anticipated that older subjects would perform more poorly on proper name, lexical fluency, and specific category fluency tasks that their younger counterparts, and that both groups would perform equivalently on general categorical fluency. While the data were as expected for the between group differences in lexical, general categorical, and proper name fluency, there was no difference in specific categorical fluency supported by the statistical analyses.

An ANOVA was conducted with age group as the between subject factor and with number of generated items by response category (vegetables, politicians, Roberts, "s") as the within subject factors. There was a significant group effect for both "Roberts" ($p = 0.005$) and "s" ($p = 0.000$), with the younger group producing significantly more words beginning with the letter "s" and significantly more "Roberts" within the one minute time frame. There was no significant effect of group on the number of politicians ($p = 0.02$) or the number of vegetables ($p = 0.046$). Planned pairwise comparisons were conducted to examine the number of items generated in each category within each group. The older group produced significantly more vegetables than Roberts ($p < 0.000$) and significantly more "s" words than Roberts ($p < 0.000$), but demonstrated no significant difference between the number of vegetables and the number of politicians ($p = 0.47$) or between the number of vegetables and "s" words ($p = 0.08$). The younger group produced significantly more vegetables than Roberts ($p < 0.000$), significantly more "s" words than vegetables ($p < 0.000$) or Roberts ($p < 0.000$), and there was no significant difference between the number of politicians and vegetables they produced ($p = 0.67$). Mean performance for each group on each task summarized in table 3.5 below.

Table 3-5. Word Generation

	# vegetables	# politicians	# Roberts	# "s" words
Older	M = 10.6 SD = 2.81	M = 10.1 SD = 3.15	M = 3.5 SD = 1.46	M = 12.2 SD = 3.84
Younger	M = 11.9 SD = 2.22	M = 12.3 SD = 4.12	M = 4.9 SD = 2.09	M = 20.6 SD = 4.02

Summary of between group and within group (older group) differences across experimental tasks in tables below:

Table 3-6. Between Group Differences Across Tasks

	Older Group	Younger Group	Significant Difference
% Recognized Faces	m = 66.9	m = 54.2	Yes (p=0.0008)
% Sorrted by Profession	m = 95.2	m = 95.8	No (p = 0.56)
% Familiar Faces Named	m = 78.6	m = 79.6	No (p = 0.17)
% Semantic Info (verbal)	m = 88.3	m = 92.3	Yes (p = 0.008)
% Semantic Info (non-verb)	m = 83.7	m = 93.6	Yes (p = 0.002)
% Phonologic Information	m = 91.3	m = 91.3	No (p = 0.985)
Generation: "s"	m = 12.2	m = 20.6	Yes (p = 0.000)
Generation: vegetables	m = 10.6	m = 11.9	No (p = 0.046*)
Generation: politicians	m = 10.1	m = 12.3	No (p = 0.02*)
Generation: "Roberts"	m = 3.5	m = 4.9	Yes (p = 0.005)
% Familiar Birds	m = 82.5	m = 77.5	No (p = 0.18)
% Famiiar Birds Named	m = 82.3	m = 77.3	No (p = 0.17)
% Phonologic Info (birds)	m = 85.8	m = 78.7	No (p = 0.01**)

* Bonferroni adjustment for Type 1 error set alpha = 0.006
** Bonferroni adjustment for Type 1 error set alpha = 0.007

Table 3-7. Within Group (Older) Differences Across Tasks

	Faces	Birds	Significant Difference
% Familiar	m = 66.9	m = 82.5	Yes (p = 0.0003)
% Named	m = 78.6	m = 82.3	No (p = 0.032*)
% Phonological Information	m = 91.3	m = 85.8	No (p = 0.0008**)

* Bonferroni adjustment for Type 1 error set alpha at 0.0167
** Bonferroni adjustment for Type 1 error set alpha at 0.0007

CHAPTER 4
DISCUSSION

The purpose of this dissertation was to further assess the observation that proper name recall decline occurs with normal aging, and to explore possible lexical, semantic, and age-related differences in patterns of performance on proper naming tasks. Several mechanisms might account for a decline in proper name retrieval as a function of normal aging, including: the arbitrary nature of proper name assignment, the specificity of search needed to select the appropriate proper name for an individual, an age-related difficulty in suppression of irrelevant information, or possible age-related degradation of lexical-phonological and/or semantic knowledge. Further, this decline might reflect an age related decrease in the ability of semantic representations to access the output lexicons.

It was predicted that normal older subjects would perform comparably to younger subjects on simple, low-specificity tasks such as identifying specific (i.e. pictures of famous people) stimuli as familiar or not and, for those faces that appeared familiar, rating their familiarity along a Likert scale. In contrast, it was predicted that the older subjects would have more difficulty with, and demonstrate poorer performance on, tasks with greater task-specificity such as sorting familiar faces by profession. Additionally, it was anticipated that older subjects would be able to name fewer familiar faces than their younger counterparts, and that the amount of semantic detail older subjects would be able to provide would be less than that provided by the younger subjects. Finally, it was expected that older subjects would perform more poorly than younger subjects on tasks which required them to access lexical and phonological characteristics of famous people's

names, both for persons they could name and persons who were familiar but who they could not name.

In addition to testing the primary predictions about proper name retrieval, this study also examined the relationship between the ability to perform recognition, conceptual-semantic, and lexical-phonological knowledge tasks for other specific, non-proper name entities (birds and objects) and the ability to perform those same tasks for proper-name stimuli. It was anticipated that there would be group differences between the ability to perform the some of the tasks, with the older group demonstrating an advantage for the non-proper name stimuli and the younger group performing comparably across all stimuli. Likewise, the younger subjects were expected to show an advantage for word generation in all task categories (general semantic, specific semantic, proper name, lexical) as compared with the older group, and both groups were expected to demonstrate the greatest difficulty with proper name recall as compared with the other tasks.

While some of these hypotheses were supported by the results, others were not. All the results, whether expected or surprising, offer opportunities to learn more about the mechanisms accounting for proper name retrieval. To explore this further, in the sections that follow each research question and its corresponding hypotheses are discussed in greater detail.

Primary Research Questions

Is There a Preferential Decline in Proper Name Retrieval with Normal Aging?

Hypothesis: Older subjects will be able to name fewer familiar faces than will younger subjects.

In considering performance on the naming task one must take into account the number of potential stimuli to be named: that is the number of stimuli identified as

familiar, unique for each participant. Rather than the young group naming a higher percentage of faces identified as familiar, there was no significant difference between the two groups' performance. While this result appears to repudiate the postulate that the ability to recall proper names decreases as a function of normal aging, the patterns of performance in other tasks suggest that naming might change as a result of aging, but that the methods used to assess the naming of specific entities might have been misleading. It is neccesary to consider mediating factors that might conceal a true age-related deficit, should one exist, or explain the absence of an age-related deficit, if such is the case. To this end, consider the next hypothesis:

Hypothesis: Older and younger subjects will recognize a comparable number of stimuli as "familiar".

Instead of the two groups (older and younger) identifying equivalent numbers of stimuli as "familiar," as was intended and expected based on the selection of stimuli faces, the older group recognized significantly more of the stimuli than did the younger subjects. This difference might be a reflection of inadequate control of stimuli selection. Alternatively, however, this difference might reflect the fact that older subjects have lived longer, and since many new famous faces are introduced each year, in the absence of a memory decline the longer one lives, the more faces might be stored as "familiar." Thus, older subjects are able to recognize more recent faces as well as older faces whereas the younger subjects might never have been exposed to people who were famous decades ago. Post hoc exploration of performance by group confirmed that while older subjects recognized, on average, thirteen individuals who became famous after 1980 the younger subjects recognized, on average, only seven individuals who were famous before 1960.

Further, while there were 38 stimuli items recognized as familiar by 24 (80%) or more subjects in both groups, there were differences in the total number of stimuli identified as familiar by the same percentage of subjects in each group (older = 56 items recognized by 24 or more subjects; younger = 48 items recognized by 24 or more subjects). A breakdown of recognition by group, item-by-item, is found in Appendix D.

Does Proper Name Retrieval Decline as a Function of Search Specificity?

Hypothesis: Older subjects will have increased difficulty as compared with younger subjects as task-specificity increases.

In contrast to the simple, low-specificity task of identifying a face as recognized or not, sorting familiar faces according to the category of their profession (athlete, politician, entertainer) requires more knowledge (though not as much knowledge as that required to name the face). Thus to perform this task successfully, a subject must know more than just the fact that he or she has seen a person before, they must know something *about* that person. Rather than demonstrating a deficit in this area, the older subjects performed at the same level of accuracy as the younger group, and the respective high mean performance for each group (older m=95.2%; young m=95.8%) suggests that subjects' ranking of "familiar" was not solely based on having seen the face before, but rather was also based on some additional knowledge of that person. Additionally, both groups' high rate of accuracy on the profession sorting task suggests that simply requiring information about profession may not be sufficient to test for search-specificity related decline; in other words, while sorting by profession is more specific than simply identifying people as familiar, it may not require information recall of sufficient specificity to delineate subtle age-related decline. In point of fact, the performance of the older subjects on this task, as well as on the tasks requiring retrieval of defined semantic

facts, suggests that knowledge about profession requires a relatively "basic" level of specificity of search.

Does Proper Name Retrieval Decline as a Function of Breakdown at the Conceptual-Semantic Level?

Hypothesis: Older subjects will be able to give fewer semantic details for familiar faces as compared with younger subjects, and will be able to give fewer semantic details for those faces that were familiar but who they could not name as compared to those they could name.

As anticipated, the older subject group gave fewer semantic details for those faces they correctly named than did younger subjects. In contrast, for familiar faces that could not be named, there was no significant between-group difference in the amount of semantic information provided. However, the older subjects *did* perform significantly worse on both verbal and non-verbal semantic tasks for those familiar faces they could *not* name as compared with those they *did* name. This suggests that the amount of available semantic information was significantly greater for named faces, and further indicates that a decline in amount of relevant semantic details may be associated with a failure to name.

The detail most often omitted for the older group when giving semantic information about un-named but familiar faces was that of *naming an associate*. This observation suggests that the failure was not limited to being able to access the semantic or lexical representation of a single entity. Rather, it may reflect a failure or decreased ability to access a representational domain.

The finding that older subjects, while performing comparably to younger subjects when naming faces, gave less semantic detail for named faces appears to conflict with the

observation that older subjects also had less semantic information for faces they could not name as compared with those they could name. Most information processing models of visual naming suggest that after the formation of percepts and the activation of object recognition units, the visual object recognition units access conceptual-semantic representations and naming occurs as a function of activation of the output lexicon through semantic processing (Ellis & Young, 1996). Thus, it would be expected that if subjects were able to *name* a stimulus, they would be able to fully access *semantic details* about that stimulus. However, it has been posited that there might be two routes to verbal naming -- one involving activation of the output lexicon by semantics and one relying on activation of the lexicon directly from the visual representation (Diesfeldt, 1991). This dichotomy has been illustrated in patients with Alzheimer's disease who demonstrated significant deficits in semantic processing but still performed well on confrontation naming tasks (Shuren, Geldmacher, & Heilman, 1993). This phenomenon of impaired semantic knowledge in the context of well-preserved confrontation naming, dubbed "nonoptic aphasia", allows for a situation in which partial semantic impairment with a preserved direct visual-lexical route results in errors in naming to description and to definition, but accuracy on confrontation naming.

While the subjects in this study were not asked to "name" famous individuals in response to verbal description or verbal presentation of a cohort's name, they were asked to generate semantic information about the stimuli; in effect, they were asked to provide a "definition" for the stimuli. The fact that they showed decline in the ability to do this task when compared with younger subjects, while at the same time demonstrating no decline in their ability to name to confrontation the stimuli, suggests that they have at least some

semantic degradation and are likely relying more on the direct visual-lexical route to generate their responses. To test this hypothesis further studies will have to be performed in which older and younger subjects are asked to name famous individual based on verbal descriptors (i.e. Who starred in "High Noon"?).

Does Proper Name Retrieval Decline as a Function of Breakdown at the Lexical-Phonological Level?

Hypothesis: Older subjects will perform more poorly than younger subjects on tasks that require them to access lexical and phonological characteristics of famous people's names, both for persons they could name and persons who were familiar but who they could not name.

In contrast to the stated hypothesis, older subjects did *not* differ from the younger group in their ability to make rhyme/lexical decision tasks for either named or un-named, familiar stimuli. However, the difference between the two groups did approach significance for the un-named familiar items, with the younger group hinting at an advantage in this domain. In addition, the older group did perform significantly better on the task with named as opposed to un-named familiar items, as did the younger group. Overall, the results from the lexical-phonological tasks suggest that a decline in this domain is not contributory to a potential decline in proper name retrieval as a function of normal aging.

One consideration is that the task required merely a yes/no response on the subjects' behalf, determining whether or not a presented non-word rhymed with the last name of the target stimuli, and so any subject had a 50% chance of performing accurately simply by guessing. Given the high level of chance in this task, a better approach in future would be to structure the lexical-phonological task along a multi-step process, such that

subjects had to both determine if a word rhymed with the name of the target, produce their own correct rhyme if they judged the presented one was incorrect, and give the first letter of the target's name. In so crafting the test demands, it is likely that a clearer picture of possible disparities in lexical-phonological information, both between groups and within group as a function of naming performance, could be achieved.

Secondary Research Questions

In addition to the primary research questions detailed above, this study also undertook the task of examining potential differences between and within group on "naming" tasks as a function of whether or not responses were self-generated or stimuli-cued. Further, the study was designed to determine whether performance on self-generated "naming" tasks differed within and between groups as a function of whether or not they revolved around proper name retrieval, or the retrieval of other highly specific entities (bird names), or more general entities (objects). In other words, does aptitude in self-generated vs stimuli cued responses differ among groups, and are proper names really "special," or just specific? Let us now consider the findings in these areas.

Does Aptitude in Self-Generated vs Stimuli Cued Responses Differ Among Experimental Groups?

Hypothesis: Older subjects will perform more poorly on proper name fluency, lexical fluency, and specific category fluency tasks that their younger counterparts, and both groups will perform equivalently on general categorical fluency.

As anticipated, it was the younger subject group that performed significantly better when asked to spontaneously generate proper name exemplars on cue ("name as many 'Roberts' as you can"). Also as expected, the younger subjects performed better than the older experimental group on the lexical fluency task (words beginning with "s"). There

was no significant difference between groups for general semantic categorical generation (expected) or specific semantic categorical fluency tasks (unexpected). Delving into the within group differences, we find that the consistent pattern between both groups is that generating proper name exemplars is significantly more difficult than all other categories, with differences between other fluency tasks demonstrating a mixed pattern within groups.

In this domain, at least, it appears that proper name retrieval is indeed more difficult than all other types of lexical-phonological or categorical-semantic generation tasks, for both subject groups. Although the advantage in proper name generation demonstrated by the younger subject group is small (younger: m = 4.9, SD = 2.09 vs older: m = 3.5, SD = 1.46), the overarching finding seems to be that the spontaneous generation of proper names is more difficult than generation of other types of information, and that in contrast to confrontation naming (in which the two experimental groups demonstrated no significant difference in performance), there is an expected *advantage* for younger subjects. In the generation tasks, where no direct activation of the lexicon by visual representation is possible, the mildly impaired semantic system is unable to produce responses as accurately as that of the younger subjects; this is consistent with subtle semantic deficits and resulting increased reliance on visual-lexical connections as discussed above;.

Are Proper Names Really "Special," or Just Specific?

Hypothesis: Older subjects will perform with greater accuracy on naming, familiarity, and lexical-decision tasks for non-proper name, specific stimuli (breeds of birds) and general stimuli (objects) as compared with proper name stimuli.

Consistent with predictions, older subjects did in fact identify a significantly greater percentage of the bird and object stimuli as "familiar" as compared with the face stimuli. They rated 100% of the object stimuli as familiar, and successfully named 99% of the items as group. While the difference between the percentage of familiar faces named and the percentage of familiar birds named did not reach statistical significance ($p = 0.032$; Bonferroni correction $p = 0.0167$), the mean percentage of familiar birds named (82.3) was greater than that of familiar faces named (78.6). The only task that failed to demonstrate a "bird" advantage was lexical-phonological knowledge in which there was an almost-advantage for named face stimuli as compared with birds ($p = 0.008$; Bonferroni $p = 0.007$). Not included in the original analysis, but conducted post-hoc in review of the data, was a comparison of the mean accuracy on the lexical-phonological task for familiar *un-named* faces and birds; this demonstrated a significant difference ($p < 0.000$) between the two stimuli categories within the older group, with older subjects performing the task with much less accuracy for un-named, familiar faces as compared with un-named, familiar birds.

Taken together, these data suggest that other non-person, specific stimuli (breeds of birds) are more recognizable than faces, that they are named with slightly greater (though not statistically significant) accuracy, and that lexical-phonological information about un-named, familiar non-person stimuli is more readily available than that for un-named, familiar persons. While no equivalent "non-person" semantic tasks were devised for this study due to the difficulties of constructing them and the highly specialized degree of bird knowledge required to answer questions about habitat (surrogate for "associate") and food preference (surrogate for "profession"), the familiarity, lexical-phonological, and

naming tasks offered the chance to compare proper name information to another category of highly specific entities. The results are highly suggestive that proper names are indeed "special," and that any deficit in their retrieval cannot be explained merely on the basis of search specificity.

Comments on Methodology

As with any study, there were methodological concerns discovered in retrospect that could be addressed in future studies. Chief among these is the discrepancy between groups in the number of stimuli identified as "familiar," the lack of complexity-hierarchy in the lexical-phonological tasks, and the lack of conceptual-semantic tasks for the non-proper name, specific stimuli.

As posited above, it is possible that the expected group difference in the percentage of familiar faces correctly named would have been observed had the younger group recognized a larger number of faces. To this end, any future studies should attempt to increase the number of familiar faces for younger subjects by either increasing the overall number of stimuli, or shifting the stimuli representation so that there are a larger number of "recently" famous faces. Given that the older subjects recognized a large number of "recent" faces, and that the former method might merely preserve or widen the between-group familiarity gap based on the stimuli chosen, the latter is suggested as the better solution.

Additionally, strong conclusions regarding lexical-phonological knowledge about proper-name stimuli is problematic in the given design where at least 50% of subject accuracy could reflect nothing more than chance. To achieve a more informative data set, it is necessary to increase complexity of lexical-phonological judgment tasks along a continuum. Suggestions for this include asking the person to self-generate their own

correct rhyme when an incorrect rhyme is identified, and asking the subject to provide the first letter of the target's name.

Finally, it is difficult to make any definitive statements about the amount of conceptual-semantic information available for proper names as opposed to other specific semantic entities without comparison tasks of similar demand. Even though equivalent tasks are highly desirable, the challenge of creating such a task without requiring a high degree of extremely specialized knowledge makes this problematic.

The Problem of Time

In addition to the semantic and lexical-phonological influences on naming performance already discussed, the data collected in this study raise the issue of processing speed as a potential influence on performance. While older subjects were able to name a comparable portion of familiar faces as compared with younger subjects, they took longer to do so. The notion of cognitive slowing, or *bradyphrenia*, is one that is well-documented in the subcortical dementia literature. It is noted as a clinically likely sequelae of subcortical dysfunction (Turner, Moran, & Kopelman, 2002), as a common accompaniment to the motor deficits and basal ganglia dysfunction of Parkinson's disease (Lees, 1994), and as a factor in difficulty with high levels of external cueing as a results of depression and damage to frontal-striatal circuits (Rogers, Bradshaw, Phillips, Chiu, Vaddadi, Presnel, & Mileshkin, 2000). Moreover, the cognitive slowing in Parkinson's (PD) is often disproportionate to the overall level of cognitive function, indicating that bradyphrenia is a separate entity than general cognitive decline (Pate & Margolin, 1994).

In other words: while bradyphrenia can, and often does, occur in combination with executive cognitive deficits, it exerts more influence on performance than what can simply be attributed to dementia or mild cognitive impairment. Both PD patients and

age-matched controls demonstrated significant cognitive slowing as compared with younger adults on a task which required judgments as to the order of onset of two lights, with no difference in performance noted between PD and non-PD age-matched subjects on the task (Phillips, Schiffter, Nicholls, Bradshaw, Iansek, & Saling, 1999). Thus while bradyphrenia is often associated with damage to subcortical circuits, specifically those involving the basal ganglia and striatum, it appears to also result from "normal" aging though the reason why bradyphrenia occurs with aging is not, however, known.

The present study did not impose any time limit on the tasks, and detailed time-course data were not recorded. However, the older subjects *did* require, on average, one hour longer to complete the experiment. Given this fact, if a time limit *were* imposed it is highly likely that they older subject group would have performed considerably more poorly than the younger subject group by virtue of the fact that they would have either not been able to complete all tasks/view all stimuli (if the time limit was imposed on the total session rather than individual items), or not been able to retrieve their full scope of semantic information/item name before being forced to go on to another item (if the time limit was imposed on an item-by-item basis).

The Issue of Engagement

Another issue to consider in interpreting the present results is that of subject engagement. On the whole, the older subject group was more interested in the task, and more apt to ponder carefully before making decisions regarding recognition, semantic information, naming, etc. In contrast, subjects in the younger group were more likely to exclude items as un-recognized after brief exposure, and to quickly move to the next item if semantic details, name, etc were not quickly forthcoming. These differences likely reflect the fact that for the older group, all volunteers recruited from community fliers,

participation in the study represented a self-motivated activity that was also a pleasurable social event whereas for the younger subjects the study was of less interest, and represented time-competition for other leisure activities.

Conclusions

Despite the limitations of this study, it seems clear that there is something "unique" about proper names as entities, and that they differ from other highly specific entities and general item categories in the amount of semantic and phonologic information available about them. The strongest trend in this data suggests that failure to name an individual reflects a deficit in semantic information and that, in general, older subjects provide fewer semantic details than their younger counterparts, and likely rely more heavily on direct visual-lexical activation. While the lexical-phonological data are equivocal, the fact that older subjects show a decline in lexically mediated generation tasks as compared with younger subjects suggests that group differences in phonological knowledge of proper names might emerge with more hierarchically designed tasks. Finally, the one factor not controlled at all in this study is that of processing time; it may very well be that by imposing timing restrictions on all the tasks the older group (which took, on average, 3.5 hours to complete the experiment) would show significant deficits in all areas as compared with the younger subjects (who took, on average, 2.4 hours to complete the experiment).

APPENDIX A
LIST OF PROPER NAME STIMULI

Aguilera, Christina
Anniston, Jennifer
Armstrong, Louis
Arnold, Eddie
Arquette, David
Ashe, Arthur
Astaire, Fred
Ball, Lucile
Berry, Halle
Bassett, Angela
Bennett, Tony
Berra, Yogi
Bin Laden, Osama
Bogart, Humphrey
Bon Jovi, Jon
Brady, Tom
Brando, Marlon
Brokaw, Tom
Burns, George
Burton, Richard
Bush, George W.
Callas, Maria
Carter, Jimmy
Cash, Johnny
Castro, Fidel
Chaplin, Charlie
Cheney, Dick
Cher
Childs, Julia
Churchill, Winston
Clarkson, Kelly
Clift, Montgomery
Cline, Patsy
Clinton, Bill
Cole, Nat King
Connery, Sean

Crawford, Joan
Cronkite, Walter
Crosby, Bing
Cruise, Tom
Dangerfield, Rodney
Davis, Betty
de Gaulle, Charles
De Niro, Robert
Dempsey, Jack
Diaz, Cameron
Duchovny, David
Einstein, Albert
Eisenhower, Dwight
Favre, Brett
Flynn, Errol
Fonda, Henry
Ford, Gerald
Ford, Harrison
Franklin, Aretha
Gable, Clark
Garland, Judy
Gehrig, Lou
Glaser, Paul Michael
Goodman, Benny
Gorbachev, Mickail
Gore, Al
Grant, Hugh
Green, Lorne
Hamm, Mia
Hasselhoff, David
Hepburn, Audrey
Holly, Buddy
Hoover, Herbert
Hope, Bob
Hudson, Rock
Hussein, Saddaam
Iglesias, Enrique
Jackson, Bo
Jackson, Janet
John, Elton
Johnson, Randy
Kelley, Grace
Kelly, Gene
Kennedy, John
Kennedy, Robert
Kidman, Nicole

King, Billie Jean
Kitt, Eartha
Koppel, Ted
Kornikova, Anna
Kruschev, Nikita
Lansbury, Angela
Lee, Brenda
Leigh, Vivien
Leno, Jay
Lenon, John
Letterman, David
Martin, Ricky
Nixon, Richard
Paltrow, Gwyneth
Pfieffer, Michele
Pitt, Brad
Poitier, Sidney
Powell, Colin
Presley, Elvis
Reagan, Ronald
Redford, Robert
Reeve, Christopher
Ripkin, Cal
Roberts, Julia
Rosenbaum, Michael
Shatner, William
Schwarzeneggar, Arnold
Sinatra, Frank
Smith, Will
Soul, David
Spacey, Kevin
Schneider, Jon
Streisand, Barbara
Taylor, Elizabeth
Thatcher, Margaret
Turner, Tina
Washington, Denzel
Willis, Bruce

APPENDIX B
LIST OF BIRD STIMULI

Canary
Cardinal
Chicken
Cockatoo
Eagle
Hawk
Flamingo
Humingbird
Ostrich
Owl
Parakeet
Parrot
Peacock
Pellican
Penguin
Pidgeon
Robin
Seagull
Turkey
Vulture

APPENDIX C
LIST OF OBJECT STIMULI

Bed
Glass
Television
Toilet
Car
Flower
Paintbrush
Plate
Handsaw
Spoon
Wallet
Toothbrush
Comb
Saddle
Trenchcoat
Umbrella
Spatula
Telephone
Ring
Pencil

APPENDIX D
LIST OF FACE STIMULI NAMED BY GROUP

	Older	Younger
Aguilera, Christina	16	25
Anniston, Jennifer	23	28
Armstrong, Louis	25	17
Arnold, Eddie	22	6
Arquette, David	3	16
Ashe, Arthur	16	9
Astaire, Fred	21	11
Ball, Lucile	28	25
Berry, Halle	21	29
Bassett, Angela	6	13
Bennett, Tony	30	28
Berra, Yogi	14	3
Bin Laden, Osama	26	27
Bogart, Humphrey	22	10
Bon Jovi, Jon	13	21
Brady, Tom	9	7
Brando, Marlon	23	14
Brokaw, Tom	29	17
Burns, George	30	24
Burton, Richard	26	17
Bush, George W.	30	30
Callas, Maria	7	0
Carter, Jimmy	30	28
Cash, Johnny	29	22
Castro, Fidel	30	28
Chaplin, Charlie	2	1
Cheney, Dick	24	23
Cher	20	23
Childs, Julia	23	21
Churchill, Winston	27	17
Clarkson, Kelly	14	26
Clift, Montgomery	13	3
Cline, Patsy	30	12
Clinton, Bill	30	30
Cole, Nat King	25	18
Connery, Sean	30	28
Crawford, Joan	20	16
Cronkite, Walter	26	13

Crosby, Bing	25	12
Cruise, Tom	27	30
Dangerfield, Rodney	16	19
Davis, Betty	22	19
de Gaulle, Charles	5	1
De Niro, Robert	21	21
Dempsey, Jack	9	0
Diaz, Cameron	21	26
Duchovny, David	11	12
Einstein, Albert	30	30
Eisenhower, Dwight	30	19
Favre, Brett	16	17
Flynn, Errol	19	7
Fonda, Henry	20	11
Ford, Gerald	26	8
Ford, Harrison	22	26
Franklin, Aretha	18	13
Gable, Clark	30	25
Garland, Judy	30	24
Gehrig, Lou	11	2
Glaser, Paul Michael	13	9
Goodman, Benny	16	4
Gorbachev, Mickail	23	18
Gore, Al	29	30
Grant, Hugh	18	25
Green, Lorne	21	16
Hamm, Mia	7	9
Hasselhoff, David	16	23
Hepburn, Audrey	26	28
Holly, Buddy	29	26
Hoover, Herbert	24	10
Hope, Bob	28	28
Hudson, Rock	24	15
Hussein, Saddaam	30	30
Iglesias, Enrique	14	23
Jackson, Bo	13	6
Jackson, Janet	17	19
John, Elton	16	21
Johnson, Randy	18	9
Kelley, Grace	25	17
Kelly, Gene	26	12
Kennedy, John	30	29
Kennedy, Robert	30	27
Kidman, Nicole	24	30
King, Billie Jean	13	5
Kitt, Eartha	9	1

Koppel, Ted	30	27
Kornikova, Anna	7	13
Kruschev, Nikita	23	8
Lansbury, Angela	30	25
Lee, Brenda	22	6
Leigh, Vivien	23	19
Leno, Jay	29	30
Lenon, John	29	29
Letterman, David	26	28
Martin, Ricky	6	16
Nixon, Richard	30	30
Paltrow, Gwyneth	23	29
Pfieffer, Michele	23	22
Pitt, Brad	28	29
Poitier, Sidney	20	11
Powell, Colin	26	25
Presley, Elvis	30	30
Reagan, Ronald	30	30
Redford, Robert	29	28
Reeve, Christopher	28	29
Ripkin, Cal	16	3
Roberts, Julia	28	30
Rosenbaum, Michael	6	2
Shatner, William	18	14
Schwarzeneggar, Arnold	30	30
Sinatra, Frank	30	23
Smith, Will	26	30
Soul, David	9	6
Spacey, Kevin	15	8
Schneider, Jon	16	11
Streisand, Barbara	28	29
Taylor, Elizabeth	30	28
Thatcher, Margaret	24	13
Turner, Tina	21	21
Washington, Denzel	24	29
Willis, Bruce	23	26

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BIOGRAPHICAL SKETCH

Amber Hollingsworth began her academic career at the University of Florida as an undergraduate in 1992. She graduated with a B.A. in communication sciences and disorders, and went on to continue her education at the University of Florida, earning a M.A. in speech pathology and pursuing her doctorate focused on adult neurolinguistic communication deficits and treatment. Ms. Hollingsworth completed her clinical coursework and clinical fellowship year at the Veterans Administration Medical Center in Gainesville, and went on to complete a pre-doctoral clinical research fellowship there as well. While completing her dissertation, she worked as a clinical research clinician at the V.A. hospital, and has presented research findings at national and international conferences as well as the University of Florida Graduate Student Symposium.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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Month & Year of Graduation

Dean, Graduate School